II. THE OFFICE ACTION

A. Rejection based on 35 U.S.C. § 112, first paragraph:

The Examiner rejected claims 33, 34, 37, 38, 47 and 48 under 35 U.S.C. § 112, first paragraph as allegedly containing new matter because of the recitation of "free of exposure of sulfuric acid prior to use." Applicants respectfully traverse.

Without acquiescing to the position of the Examiner, claims 33, 34, 37 and 38 have been canceled without prejudice or disclaimer and claims 47 and 48 have eliminated this recitation from the claim. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

B. Rejection based on 35 U.S.C. § 112, second paragraph:

The Examiner rejected claims 31, 32 and 40 under 35 U.S.C. § 112, second paragraph as allegedly indefinite for the recitation of "high" which was alleged to be subjective and unclear. Applicants respectfully traverse.

At the outset, Applicants note that the term "high" is also recited in claims 7 and 48. Without acquiescing to the position of the Examiner, claims 31 and 32 have been canceled without prejudice or disclaimer and claims 7, 40 and 48 have eliminated this term from the claim. Claims 7, 40 and 48 now recite "deep desulfurization." The phrase "high depth desulfurization" is synonymous with "deep desulfurization."

"Deep desulfurization" is a common, established term in the art as evidenced by the following:

1. Japanese Patent Provisional Publication No. 2001-062297 "deep desulfurization catalyst, its production and desulfurization method using same", abstract only.

2. Japanese Patent Provisional Publication No.09-164334 "preparation of hydrodesulfurization catalyst for light oil", abstract only.

3. US patent No. 5,232,854 "Multistage system for deep desulfurization of fossil fuels".

4. US patent No. 5,387,523 "Multistage process for deep desulfurization of fossil fuels".

5. US patent No. 5,454,933 "Deep desulfurization of distillate fuels".

6. US patent No. 5,510,265 "Multistage process for deep desulfurization of a fossil fuel".

7. US patent No. 5,958,224 "Process for deep desulfurization using combined hydrotreating-oxidation".

8. US patent No. 6,042,719 "Deep desulfurization of FCC gasoline at low temperatures to maximize octane-barrel value".

Copies of the cited documents are attached hereto as Exhibits 1-8. Thus, the term that Applicants use is commonly used in the art and as such, evidences its accepted meaning and therefore is clear and definite.

Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

C. Rejection based on Obviousness-type Double Patenting:

The Examiner has rejected claims 6, 7 and 20-52 under Obviousness Type Double Patenting. Applicants respectfully traverse.

At the outset, Applicants would direct the Examiner's attention to the claims of U.S. Patent No. 6,106,791 which recite a method of removing nitrogen oxides from exhaust gas and a method of removing nitrogen oxides and sulfur oxides from exhaust gas. The present claims are directed to a method of desulfurization, not a method of removing nitrogen oxides. This is clearly a different method which is not obvious from the parent patent without the Examiner improperly using Applicants own specification for the teachings necessary to reject the claims based on Obviousness type double patenting.

Furthermore, the grandparent application to the present case set forth a restriction between methods of desulfurization and methods of denitration. Because the restriction is evidence that the PTO considers the method of desulfurization and the method of denitration

to be independent and distinct so as to support separate patents, the PTO cannot later reject the same claims over the parent application which adhered to the restriction requirement.

According to MPEP § 804.01:

> 35 U.S.C. 121 authorizes the Commissioner to restrict the claims in a patent application to a single invention when independent and distinct inventions are presented for examination. The third sentence of 35 U.S.C. 121 prohibits the use of a patent issuing on an application with respect to which a requirement for restriction has been made, or on an application filed as a result of such a requirement, as a reference against any divisional application, if the divisional application is filed before the issuance of the patent. The 35 U.S.C. 121 prohibition applies only where the Office has made a requirement for restriction.
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> . . . . The following are situations where the prohibition of double patenting rejections under 35 U.S.C. 121 does not apply:
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> (A) The applicant voluntarily files two or more applications without a restriction requirement by the examiner. *In re Schneller*, 397 F.2d 350, 158 USPQ 210 (CCPA 1968).
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> (B) The claims of the different applications or patents are not consonant with the restriction requirement made by the examiner, since the claims have been changed in material respects from the claims at the time the requirement was made. For example, the divisional application filed includes additional claims not consonant in scope to the original claims subject to restriction in the parent. *Symbol Technologies, Inc. v. Opticon, Inc.*, 935 F.2d 1569, 19 USPQ2d 1241 (Fed. Cir. 1991) and *Gerber Garment Technology, Inc. v. Lectra Systems, Inc.*, 916 F.2d 683, 16 USPQ2d 1436 (Fed. Cir. 1990). In order for consonance to exist, the line of demarcation between the independent and distinct inventions identified by the examiner in the requirement for restriction must be maintained. 916 F.2d at 688, 16 USPQ2d at 1440.
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> (C) The restriction requirement was written in a manner which made it clear to applicant that the requirement was made subject to the nonallowance of generic or other linking claims and such generic or linking claims are subsequently allowed. Therefore, if a generic or linking claim is subsequently allowed, the restriction requirement must be withdrawn.
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> (D) The requirement for restriction (holding of lack of unity of invention) was only made in an international application by the International Searching Authority or the International Preliminary Examining Authority.

> (E) The requirement for restriction was withdrawn by the examiner before the patent issues. *In re Ziegler*, 443 F.2d 1211, 170 USPQ 129 (CCPA 1971).
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> (F) The claims of the second application are drawn to the "same invention" as the first application or patent. *Studiengesellschaft Kohle mbH v. Northern Petrochemical Co.*, 784 F.2d 351, 228 USPQ 837 (Fed. Cir. 1986).
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> While the situation should not arise where appropriate care is exercised in defining the independent and distinct inventions in a restriction requirement, the issue might arise as to whether 35 U.S.C. 121 prevents the use of a double patenting rejection when the identical invention is claimed in both the patent and the pending application. Under these circumstances, the Office will make the double patenting rejection because the patentee is entitled only to a single patent for an invention. As expressed in *Studiengesellschaft Kohle*, 784 F.2d at 361, 228 USPQ at 844, (J. Newman, concurring), " 35 U.S.C. 121 of course does not provide that multiple patents may be granted on the identical invention."

In the present case, the Examiner set forth a restriction between the method of desulfurization and the methods of denitration in the grandparent application and none of the exceptions to the commonly accepted rule are applicable here. Applicants have relied on this restriction and have prosecuted their subsequent patent applications accordingly. Based on the restriction requirement setting forth that the claims directed to a method of desulfurization and a method of denitration are separate and distinct, the rejection based on obviousness type double patenting is improper. Furthermore, since the claims of U.S. Patent No. 6,106,791 are directed to a method of denitration and the present claims are directed to methods of desulfurization, one skilled in the art woujld not find a method of desulfurization obvious over a method of denitration.

D. Rejection based on 35 U.S.C. § 103(a)

The Examiner has maintained the rejection of claims 6, 7 20-42 and 45-52 under 35 U.S.C. § 103(b) as allegedly unpatentable over Ninomiya et al. (U.S. Patent No. 4,210,628) in view of JP 06079176.

The Examiner has also maintained the rejection of claims 6, 7 and 20-52 under 35 U.S.C. § 103(b) as allegedly unpatentable over Hamada et al. (U.S. Patent No. 4,500,501) in view of JP 06079176. Applicants traverse the rejections.

At the outset, Applicants note that the Examiner admits that Ninomiya and Hamada are lacking the teaching of treated fibers for use in the claimed method. The Examiner relies on JP '176 to remedy the deficiencies of both Ninomiya and Hamada. The basis for such reliance on JP '176 is the allegation that JP '176 teaches hydrophobic fibers and hence can be combined with the teachings of Ninomiya and Hamada.

The Examiner asserts that the active carbon fiber of '176 are hydrophobic due to the process by which the fibers were made. Applicants disagree with the Examiner's assessment.

The active carbon fibers of '176 are prepared by baking active carbon fiber in non-oxidizing atmosphere at 600-1200°C and then subjecting the fibers to sulfuric acid activation treatment. The baking step is to remove hydrophilic oxygen-containing functional groups and the sulfuric acid activation treatment step is to introduce specific hydrophilic oxygen-containing functional groups. The specific hydrophilic oxygen-containing functional groups contribute to the ammonia binding ability of active carbon fiber. This is evidenced by the teaching of I. Mochida et al, The Chemical Society of Japan, 1992, (3), p275-281, a copy of which is attached as Exhibit 9. For example, the result of the ultimate analysis of Mochida (table 1) shows that the content of oxygen is increased from about 5% to about 10-36% and the content of sulfur is increased from trace amount to about 0.3 to 4% by sulfuric acid activation treatment. Also, the result of TPD (Temperature Programmed Description) (table 3 and Fig. 6) shows that the amounts of CO_2 and CO, which are derived from hydrophilic oxygen-containing functional groups, evolved in TPD is increased two-six fold by sulfuric acid activation treatment. (In Table 1 and 3 and Fig. 6 "original" is an activated carbon fiber untreated with sulfuric acid and the others such as 3/250/6 is the activated carbon fiber treated with sulfuric acid.)

In order to increase the ammonia binding ability, the activated carbon fiber is subjected to sulfuric acid activation treatment which introduces specific hydrophilic oxygen-containing functional groups. This, therefore, imparts a hydrophilic character to the fibers. Thus, no hydrophobic activated carbon fiber is taught or suggested by '176.

There is no motivation to combine Ninomiya or Hamada with an active carbon fiber prepared only by baking active carbon fiber and not subjected to sulfuric acid activation treatment.

In addition, one of the problems of the prior art is the use of ammonia as acknowledged by Applicants in their discussion of the prior art on page 3, lines 22-25 of the present specification, which states that "this process involves the following problems, ... secondly, NH_3 is required". Both Ninomiya and Hamada require the use of ammonia in their methods of treating exhaust gas. Both use of NH_3 in the processes of Ninomiya and Hamada are as follows:

In Ninomiya, the nitrogen oxide reduction reaction can be shown by the following reaction schemes (column 5, 1st paragraph):

$$6N0 + 4NH_3 \rightarrow 5N_2 + 6H_20 \quad (1)$$
$$6N0 + 8NH_3 \rightarrow 7N_2 + 12H_20 \quad (2)$$

In Hamada, sulfur and nitrogen oxides are removed by using a carbonaceous adsorbent such as coke, adding ammonia to a waste gas and removing sulfur and nitrogen oxides as ammonium compound.

Thus, the combination of JP '176 with Ninomiya or Hamada fails to remedy the problem in the art with the use of ammonia and also does not constitute a proper combination of references since JP '176 fails to teach hydrophobic fibers.

Moreover, the Examiner asserts as motivation for the combination of Hamada and JP '176 that using the fibers of JP '176 in the process of Hamada renders the Hamada process more efficient. Applicants disagree with the Examiner's assessment. The JP '176 fibers are too feathery to be applied to a moving bed. In general, the size of activated carbon fiber is on the order of μm in diameter whereas the size of the carbonaceous adsorbent used in a moving bed is on the order of mm. Thus, from a practicality standpoint, the JP '176 fibers could not be used in the process of Hamada due to the wide differences in diameter and the use of a moving bed system.

Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

III. CONCLUSION

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

Respectfully submitted,

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MARKED UP VERSION SHOWING CHANGES MADE

6. (Three times amended) A desulfurization process which comprises bringing a gas containing SO_2, water, and oxygen into contact with a hydrophobic heat-treated active carbon fiber wherein said heat-treated active carbon fiber has been obtained by heat-treating a starting active carbon in a non-oxidizing atmosphere, thereby rendering said heat-treated active carbon fiber hydrophobic**[, wherein said starting active carbon is a starting active carbon fiber]**.

7. (Three times amended) A **[high depth]** deep desulfurization process which comprises removing sulfur oxides by using a hydrophobic heat-treated active carbon fiber, wherein said heat-treated active carbon fiber has been obtained by heat-treating a starting active carbon fiber in a non-oxidizing atmosphere, thereby rendering said heat-treated active carbon fiber hydrophobic, wherein **[said heat-treating comprises heating at a temperature of 600 to 1,200°C in a non-oxidizing atmosphere,]** said removal of sulfur oxides occurring on the downstream side of a desulfurization apparatus based on the lime-gypsum method.

39. (Amended) A desulfurization process which comprises bringing a gas containing SO_2, water, and oxygen into contact with a hydrophobic heat-treated active carbon fiber wherein said heat-treated active carbon fiber has been obtained by a process consisting essentially of heat-treating a starting active carbon fiber in a non-oxidizing atmosphere, thereby rendering said heat-treated active carbon fiber hydrophobic**[, wherein said starting active carbon is a starting active carbon fiber]**.

40. (Amended) A **[high depth]** deep desulfurization process which comprises removing sulfur oxides by using a hydrophobic heat-treated active carbon fiber, wherein said heat-treated active carbon fiber has been obtained by a process consisting essentially of heat-treating a starting active carbon fiber in a non-oxidizing atmosphere, thereby rendering said heat-treated active carbon fiber hydrophobic, wherein **[said heat-treating comprises heating at a temperature of 600 to 1,200° C in a non-oxidizing atmosphere,]** said removal of

sulfur oxides occurring on the downstream side of a desulfurization apparatus based on the lime-gypsum method.

47. (Amended) A desulfurization process which comprises bringing a gas containing SO_2, water, and oxygen into contact with a heat-treated hydrophobic active carbon fiber wherein said heat-treated active carbon fiber has been obtained by heat-treating a starting active carbon fiber in a non-oxidizing atmosphere**[, wherein said starting active carbon is a starting active carbon fiber]**, wherein said heat-treating further comprises heat-treating for about an hour, **[wherein said heat-treated active carbon fiber is free of exposure to sulfuric acid prior to use,]** wherein said desulfurization process occurs between about 20°C to about 100°C**[, and wherein said process occurs]** at a gas flow rate in the range of about $1x10^{-3}$ to about $5x10^{-3}$ g-min/ml per unit weight of said active carbon.

48. (Amended) A **[high depth]** deep desulfurization process which comprises removing sulfur oxides by using a heat-treated hydrophobic active carbon fiber, wherein said heat-treated active carbon fiber has been obtained by heat-treating a starting active carbon fiber in a non-oxidizing atmosphere, wherein said heat-treating comprises heating at a temperature of 600 to 1,200°C in a non-oxidizing atmosphere, wherein said removal of sulfur oxides occurring on the downstream side of a desulfurization apparatus based on the lime-gypsum method, wherein said heat-treating further comprises heat-treating for about an hour, **[wherein said heat-treated active carbon fiber is free of exposure to sulfuric acid prior to use,]** wherein said desulfurization process occurs between about 20°C to about 100°C**[, and wherein said process occurs]** at a gas flow rate in the range of about $1x10^{-3}$ to about $5x10^{-3}$ g-min/ml per unit weight of said active carbon.